CLONASLEE FLOOD RELIEF SCHEME

Appendix 11.1: WFD Assessment - Final Report

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Clonaslee Flood Relief Scheme

Evaluation of Compliance with EU Water Framework Directive (WFD) (2000/60/EC)

October 2024

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Acronyms

BQE	Biological Quality Elements
CIS	Common Implementation Strategy
CJEU	Court of Justice of the European Union
EcIA	Ecological Impact Assessment
EIAR	Environmental Impact Assessment Report
EPA	Environmental Protection Agency
EQR	Environmental Quality Ratio
EQS	Environmental Quality Standard
GPC	General physico-chemical
GWB	Ground water body
GWDTE	Groundwater dependent terrestrial ecosystems
RBMP	River Basin Management Plan
RWB	River water body
WFD	Water Framework Directive

Glossary of Terms

Ecological status	Ecological status classification for the body of water shall be represented by the lower of the values for the biological and physico-chemical monitoring results (Annex V, 1.4.2)
Good ecological status	Article 2 (22) defines good ecological status as classified in accordance with Annex V which states GES is when "*there are slight changes in the [specific biological quality element] compared to the type-specific communities*".
Good surface water status	Article 2(18) of the WFD: "*the status achieved by a surface water body when both its ecological status and its chemical status are at least 'good'*"
Good surface water chemical status	Physicochemical and nutrient conditions are within the ranges established to ensure the functioning of the ecosystem and the achievement of the values specified for the biological quality elements and (Article 2 (24) of the WFD) "*in which concentrations of pollutants do not exceed the established environmental quality standards*".
Surface water status	Article 2(17) of the WFD: "*the general expression of the status of a body of surface water, determined by the poorer of the ecological status and the physicochemical status*"

1 INTRODUCTION

The proposed Clonaslee Flood Relief Scheme, Co Laois (the "Proposed Scheme") involves new physical modifications (instream or alongside) discrete reaches of the Clodiagh River referred to as: Area 1 (Brittas Wood), Area 2 (Chapel Street) and Area 3 (Tullamore Road and Integrated Constructed Wetland (ICW)) as shown on **Figure 1-1**.

New physical modifications can impact on hydromorphology of surface waters, potentially undermining Article 4(1) environmental objectives of the Water Framework Directive 2000/60/EC (WFD). Article 4(1) requires for all water bodies that deterioration in status must be prevented, and good status must be achieved within certain timeframes as set out in the directive.

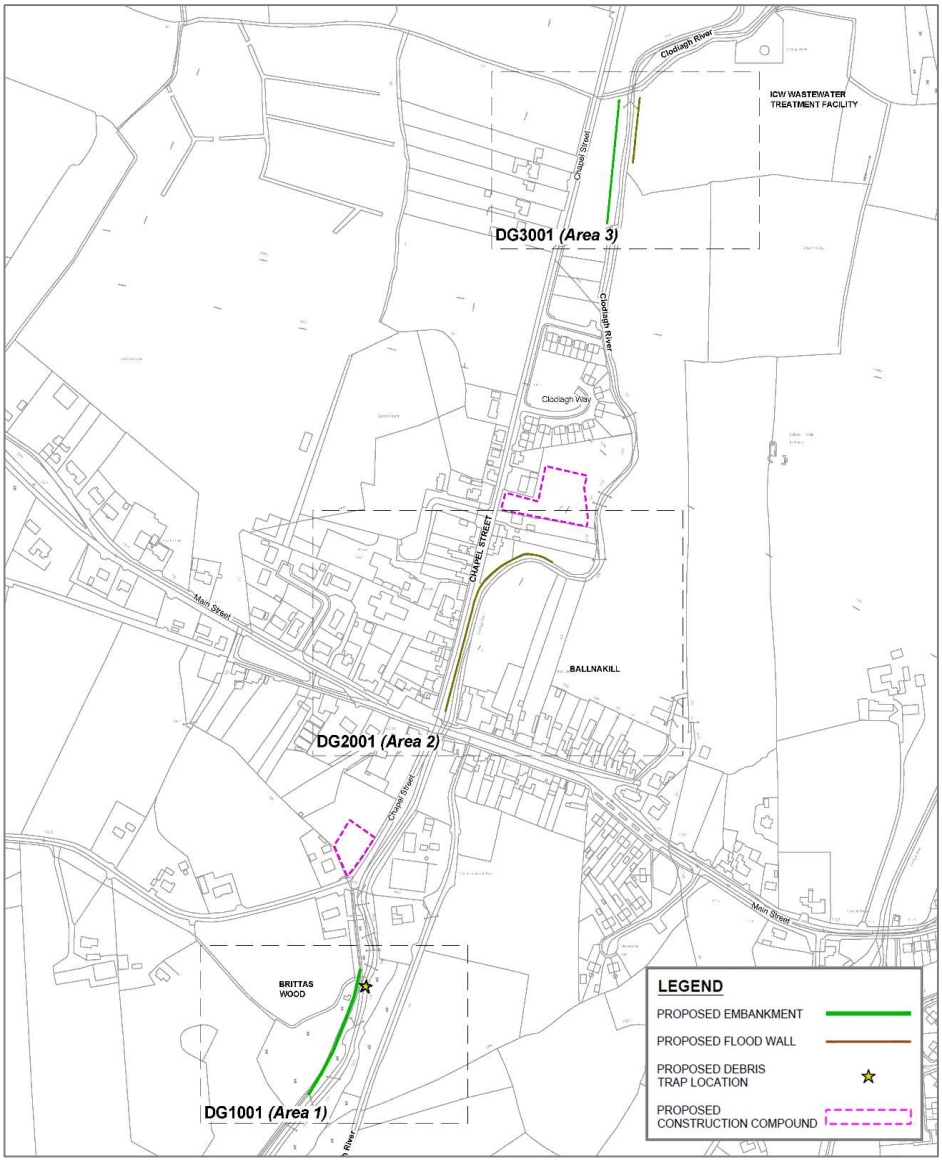

Figure 1-1 Clonaslee Flood Relief Work Areas – Clodiagh River

The Proposed Scheme will deliver benefit to the community of Clonaslee shown in **Figure 1-2** below. Please see **Appendix 1** for further descriptions of the pre- and post-scheme flooding scenarios.

Figure 1-2 Post-Scheme 1% AEP Flood Extent

Alterations to the physical condition of a water body can, however, impact on aquatic ecosystems, with consequent effects on biological quality elements and their metrics that determine surface water body status. In some cases, new physical modifications can also alter the quantitative status of groundwaters.

A key decision in the European Court of Justice (CJEU) concerning hydromorphological impact on water body status came from the [1]*Weser* case, establishing that: "*Member States are required — unless a derogation is granted — to refuse authorisation for an individual project where it may cause a deterioration of the status of a body of surface water or where it jeopardises the attainment of good surface water status … by the date laid down by the directive.*"

The aim of this document is to provide an evaluation of whether new physical modifications under the Proposed Scheme could prevent WFD Article 4(1) objectives from being achieved for any affected water body, and hence whether the project can be authorised under the WFD in the absence of derogation under Article 4(7).

[1] *Case C-461/13 Bund für Umwelt und Naturschutz Deutschland ECLI:EU:C:2015:433*

2 METHODOLOGY AND SOURCES OF INFORMATION

2.1 Resources

The following resources were consulted to inform this response:

- Water Framework Directive (2000/60/EC) full text
- WFD Common Implementation Strategy (CIS) Guidance documents (EC 2005, 2006, 2009, 2017)
- Water Action Plan 2024: A River Basin Management Plan for Ireland (DEHLGH, 2024).
- EIAR for the Clonaslee Flood Relief Scheme
- Hydraulic modelling data for cross sections along the affected reach of Clodiagh River
- Relevant Litigation relating to WFD, i.e., *Case C-461/13 Bund für Umwelt und Naturschutz Deutschland* ECLI:EU:C:2015:433 (the *Weser* case)
- Environmental Protection Agency (EPA) maps and data: https://www.catchments.ie/
- Historical OSI maps: https://www.geohive.ie
- Published scientific literature and journals (where required).

2.2 WFD Compliance Evaluation

2.2.1 Purpose of WFD Compliance Evaluation

Ireland has obligations under the WFD to manage the physical condition of all waters to protect and improve their status. The Water Action Plan 2024: Ireland's third-cycle (2022-2027) River Basin Management Plan (RBMP) contains specific actions and key agency responsibilities to deliver new technical and legislative work on hydromorphology and WFD compliance. This includes the establishment of a National Hydromorphology Programme supported by new legislation that will control physical changes in or near water that have a potential to impact on the status of water. As of October 2024 (when the current document was prepared) there were no published national guidelines relating to the process of water body status impact assessment. However, European Union (EU) Guidance on Common Implementation Strategy (CIS) for the WFD provides a framework for such assessments.

To clearly inform the Competent Authority in assessing compliance of the Proposed Scheme with WFD Article 4(1) objectives, the effects of the proposed modifications on water body status are undertaken in this document using a structured approach that is in line with: (i) EU CIS Guidance, (ii) relevant case law pertaining to WFD interpretation / application, and (iii) goals of the Water Action Plan 2024.

2.2.2 Article 4(7) Applicability Assessment

Article 4(7) of the WFD sets out rules around the authorisation of projects that involve new modifications to the physical characteristics of a body of surface water and/or alterations to the level of bodies of groundwater. If a project may lead to deterioration of status or non-achievement of good status it cannot be authorised unless it meets strict criteria under Article 4(7) to qualify for an exemption from the core objectives of the WFD.

Article 4(7) considerations apply to any project that involves a new physical alteration to a water body (such as a flood relief scheme) and/or changes to ground water levels that may affect its quantitative status. It must be determined prior to authorisation whether the project could compromise WFD objectives. The practical framework for this process is contained in *CIS Guidance No. 36: Exemptions to the Environmental Objectives according to Article 4(7) New modifications to the physical characteristics of surface water bodies, alterations to the level of groundwater, or new sustainable human development activities* (EC 2017).

The first step involves what is termed the "Article 4(7) Applicability Assessment" which evaluates how a proposed project is expected to impact on environmental objectives for each water body and to

answer the questions: (1) does the proposal lead to deterioration of water body status? or (2) does the proposal prevent attainment of good status?

As shown in **Figure 2-1**, if the answer to either question is "No" the project is compliant with WFD Article 4(1) objectives and can be authorised under the WFD. If the answer to either question is "yes" the project can only be authorised under derogation providing it meets strict criteria set out within Article 4(7) of the directive.

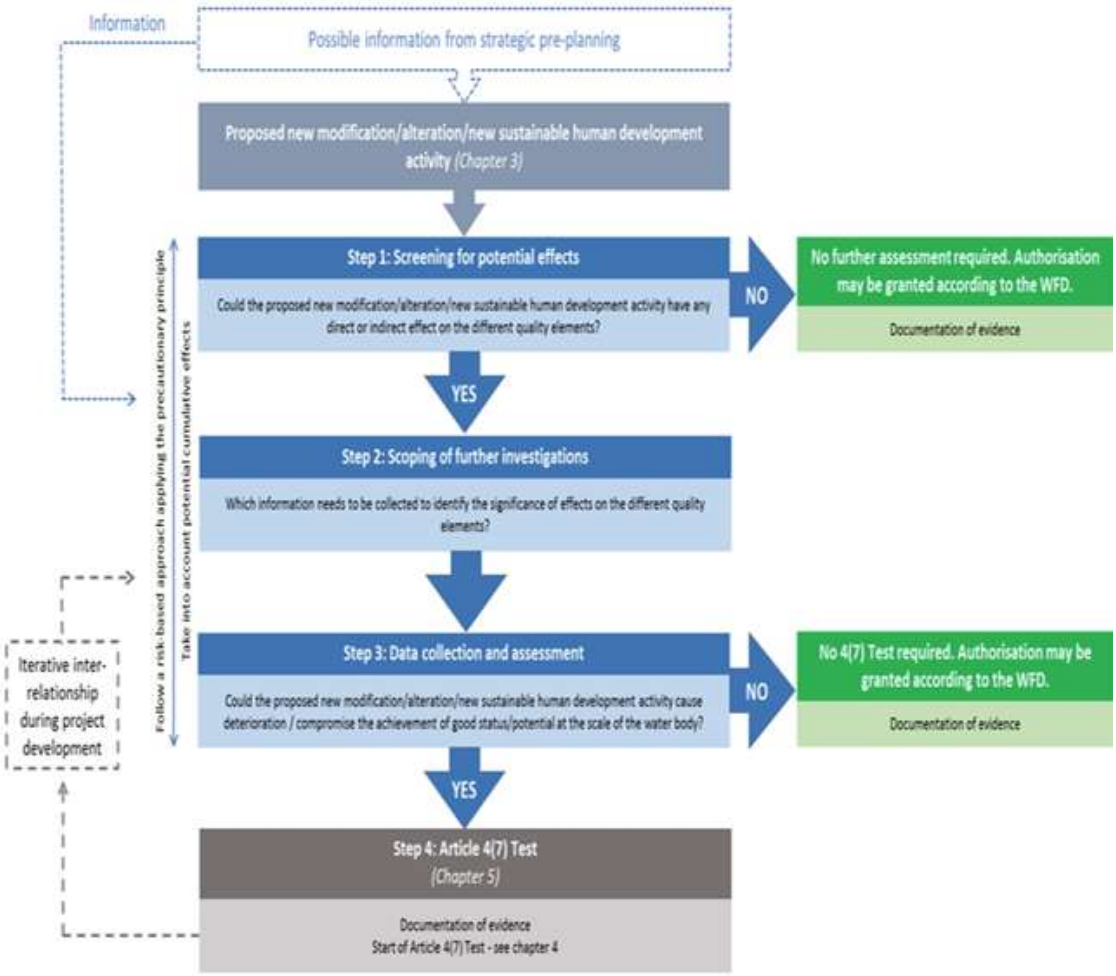

Figure 2-1 Stepwise approach for an Article 4(7) Applicability Assessment (reproduced from EC 2017)

2.2.3 Meaning of "Deterioration"

The concept of "deterioration" of water body status is not defined in the WFD. The decision provided by the CJUE in the *Weser* case, provided the following clarifications on the way in which deterioration in the context of WFD compliance should be interpreted:

- Deterioration in water body status occurs when the status of at least one of the quality elements, within the meaning of Annex V to the directive, falls by one class, even if this does not result in a fall in the overall classification of the water body.
- If the quality element is already in the lowest class (bad status), any deterioration of that element represents a deterioration of the status within the meaning of WFD Article 4(1)(a)(i).

With regards to WFD assessments the following are important to note:

- Temporary short-term effects on status during the construction or maintenance phase do not constitute “deterioration of status” and are not required to be addressed so long as there are no long-term adverse consequences and no delayed deterioration in the status of the defining quality elements expected in the water body thereafter (EC, 2017).
- Mitigation measures within the proposed project are taken into account in the Article 4(7) Applicability Assessment as they form an inherent element of the design and implementation of a project (EC, 2017).

2.2.4 Information Sources

The WFD compliance evaluation uses current EPA assigned water body status classifications (2016-2021) as the baseline against which any effects of the scheme are assessed. These are the most recent formal status classifications reported to Europe going into the RBMP 3rd cycle (2022-2027). This approach is in line with case law from the Irish High Court *Sweetman v An Bord Pleanála [2021] IEHC 16* which established that EPA assigned status is the only legal baseline against which potential changes to water body status can be evaluated.

The effects of physical modifications on WFD status are underpinned by detailed information provided in the EIAR for the Proposed Scheme, pertaining to impacts and effects on surface water and groundwater quality and instream habitats supporting the biological quality elements that define surface water body status. This document does not reassess the information contained in the EIAR but uses the detailed information and conclusions from the EIAR **Chapter 9: Aquatic Biodiversity, Chapter 10: Land, Soils, Geology and Hydrogeology** and **Chapter 11: Water**.

2.2.5 Surface Water Body Status Classification

Ecological status of River Water Bodies (RWBs) is defined in Annex V of the WFD by biological quality elements (BQEs) as well as “supporting” hydromorphological, chemical and physico-chemical elements. BQEs (e.g., macroinvertebrates, algae, fish) employ standard methods for calculating a metric to reflect an Ecological Quality Ratio (EQR), which equates to WFD status classes of High, Good, Moderate, Poor or Bad. Physicochemical quality elements are compared to statutory Environmental Quality Standards (EQSs) published in the surface water regulations which support High, Good and ≥Moderate status. Hydromorphology underpins structure and function of river ecosystems, hence sustaining the biological quality elements (BQEs).

Hydromorphological quality elements that support the BQEs for river water bodies are defined by:

- Hydrological regime (quantity and dynamics of water flow; connection to groundwater bodies)
- River continuity
- Morphological conditions (river depth and width variation; structure and substrate of the river bed, structure of the riparian zone)

The above are the physical attributes by which any impacts of the Proposed Scheme on surface water body status were assessed in this report.

2.2.6 Ground Water Body Status Classification

Groundwater body status is defined by its chemical status (concentration of pollutants) and its quantitative status (relating to ground water levels). Groundwater status is defined as being either ‘Good’ or ‘Poor’ based on the poorest of these elements. Good chemical status is defined in WFD Annex V 2.3.2 and includes meeting EQSs for pollutants, with no declining trends. The definition of good quantitative status is set out in WFD Annex V 2.1.2 (CIS Guidance No. 18, 2009). For a groundwater body to be of good quantitative status the following criteria covered by the definition of good status must be met:

- Available groundwater resource is not exceeded by the long-term annual average rate of abstraction.
- No significant diminution of surface water chemistry and/or ecology resulting from anthropogenic water level alteration or change in flow conditions that would lead to failure of relevant WFD Article 4 objectives for any associated surface water bodies.

- No significant damage to groundwater dependent terrestrial ecosystems resulting from an anthropogenic water level alteration.
- No saline or other intrusions resulting from anthropogenically induced sustained changes in flow direction.

These are the attributes by which any impacts of the Proposed Scheme on GWB quantitative status were assessed in this report.

2.2.7 Approach to WFD Compliance Evaluation

WFD compliance evaluations take the form of individual Article 4(7) Applicability Assessments to examine the effect of new physical modifications on the quality elements that define status. The method is devised by the author using the framework set out in European CIS Guidance No 36 (2017). River water bodies (RWBs) and groundwater bodies (GWBs) are addressed. The following steps were taken:

- Identification of water bodies directly affected by the proposed scheme (i.e., subject to new physical alterations).
- Identification of water bodies that may be indirectly affected by the proposed scheme (i.e., not directly subject to physical alterations but are adjoining or influenced by the project).
- Compile EPA assigned status and quality elements used to define status for each water body including biological and supporting general physico-chemical (GPC) (and chemical status where available).
- Use hydraulic model cross section output to compare baseline and post-scheme velocity and Froude number for flood scenarios: 50%AEP (i.e., smaller, more frequent events) and 1%AEP (i.e., larger, more infrequent events) (see **Appendix 2**).
- Carry out Article 4(7) Applicability Assessment to evaluate effects of new physical modification(s) on ecological status of each potentially affected water body.
- Determine for each water body whether the Proposed Scheme could cause status to deteriorate or prevent achievement of good status.

2.3 Statement of Competence

Lauren Williams BSc PGDip MCIEEM is a qualified freshwater ecologist with 24 years professional consultancy experience. Lauren holds a BSc in Zoology (University of Otago, NZ); a Certificate in Environmental Law (Open Polytechnic of NZ) and a Post Graduate Diploma in Environmental Monitoring Assessment and Engineering with Distinction from Trinity College Dublin. She is a full member of the Chartered Institute of Ecology and Environmental Management (CIEEM). Lauren specialises in water quality assessment, monitoring, aquatic Ecological Impact Assessment (EcIA), protected aquatic species and fisheries habitat surveys. She undertakes specialised aquatic field studies and reporting in relation to a broad range of infrastructural developments. Lauren has 24 years of experience in water chemistry interpretation, aquatic macroinvertebrate sampling and analysis, and is an accredited River Habitat Survey operator (RHS) and Irish River Hydromorphology Assessment Technique (RHAT) surveyor, calculating and interpreting associated metrics and applying these to WFD status classification. She carries out aquatic sampling and reporting as part of national river monitoring programmes and is a recognised aquatic protected species surveyor (freshwater pearl mussel and white-clawed crayfish). Her professional and practical skill set in assessing the biological quality elements that underpin ecological status, water quality interpretation and hydromorphology provide a qualified foundation for water body status impact assessment.

3 EFFECTS ON WATER BODY STATUS

3.1 Identification of Directly and Indirectly Affected Water Bodies

The most recently reported EPA waterbody status covers the period 2016-2021, providing formal status at the commencement of the third-cycle of the RBMP (2022-2027). Using the EPA mapping tool (https://www.openstreetmap.org/copyright/), **Figure 3-1** shows the location of surface water bodies in relation to the Proposed Scheme. **Figure 3-2** shows the potentially affected groundwater bodies.

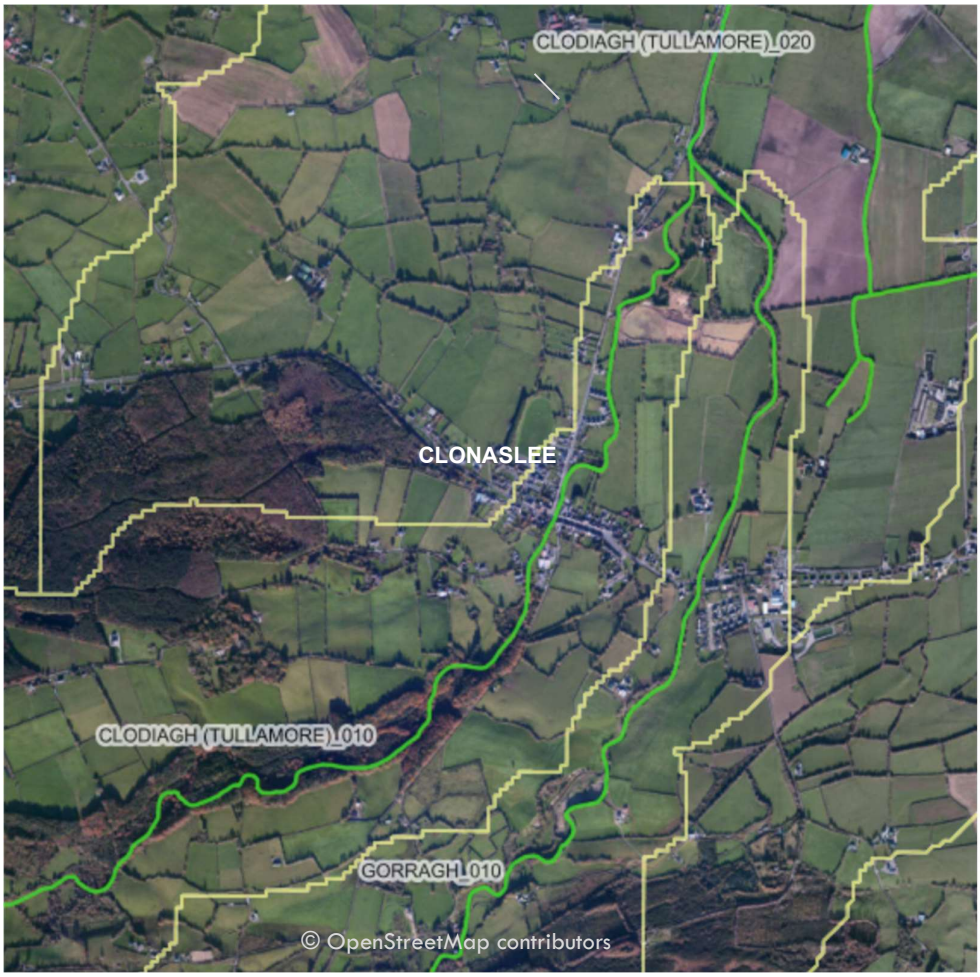

Figure 3-1 Location of directly and indirectly affected EPA river water bodies (EPA Maps)

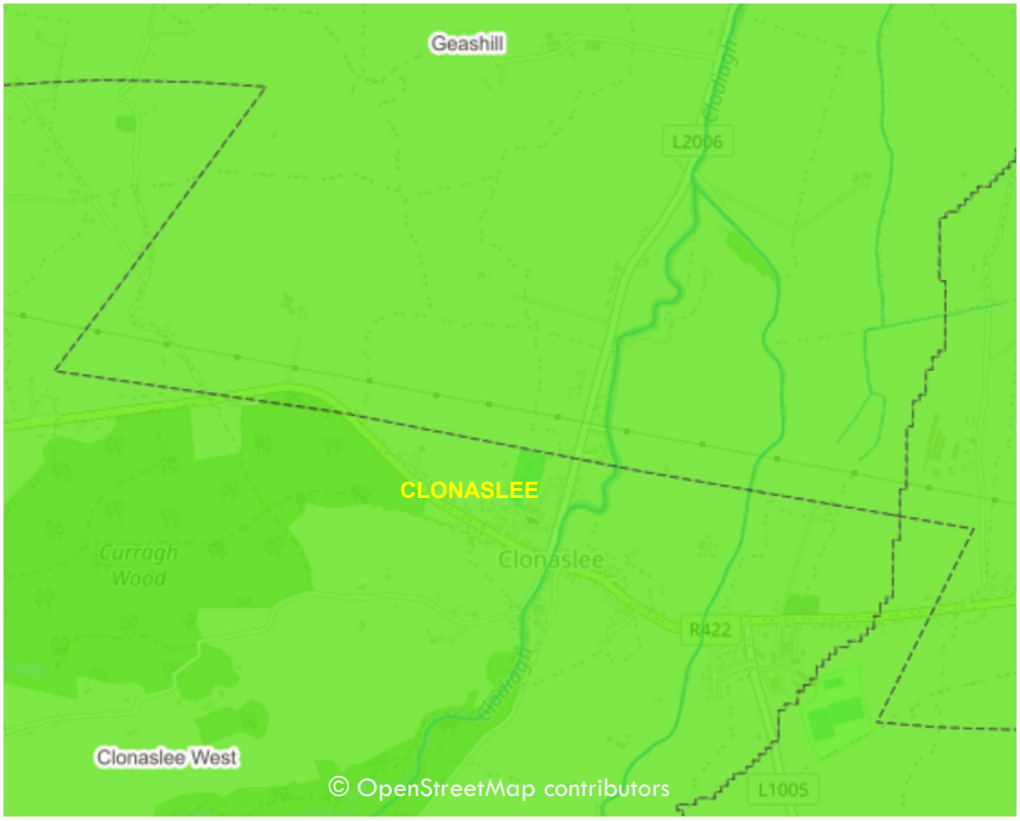

Figure 3-2 Location of EPA groundwater bodies (EPA Maps)

3.1.1 Directly Affected Water Bodies

Table 3-1 shows currently reported EPA assigned water body status for directly affected water bodies. There is one directly affected RWB and two directly affected GWBs for which Article 4(7) Applicability Assessments are presented in **Section 3.1.1.1**.

Table 3-1 Directly and Indirectly Affected Water Bodies

EPA Water Body Name [Code]	Waterbody type	EPA Status Assessment Technique	CURRENT: EPA WB Status (2016-2021)	Status Driver	WFD Objective Status	Water Body Risk	Comment on Risk
CLODIAGH (TULLAMORE)_010 [IE_SH_25C060220]	RWB	Monitored: Invertebrate, GPC, Hydromorph.	Good	Q-value (Invertebrate) Hydromorph.	Good	Not at Risk	~
Geashill [IE_SH_G_103]	GWB	*Not Monitored*	Good	~	Good	Not at Risk	~
Clonaslee West [IE_SH_G_066]	GWB	Monitored	Good	~	Good	Not at Risk	All chemical indicators are “far from threshold”

3.1.1.1 Article 4(7) Applicability Assessments

CLODIAGH (TULLAMORE)_010: A relatively small RWB (13.53 km^2) encompassing the headwater main channel of the Clodiagh River, originating in the Slieve Bloom Mountains. The Proposed Scheme affects three discrete areas at the lower (northern) end of the RWB affecting 510m of the River Clodiagh western bank ([2]LHS) and 70m of the eastern bank ([3]RHS):

- **Area 1 (Brittas Wood):** New, earthen embankment (linear length = 135m) on western bank (LHS), plus an instream debris trap. Aside from the debris trap location, where the embankment will slope down to the river bank, the embankment toe will be set back from the riverbank by a minimum of 4m, and generally in the range of 5 to 8m along its length. Natural, bankside riparian vegetation will be retained between the channel and the existing footpath at the base of the embankment. The debris trap involves securing bollards within the channel. For this assessment, the conservative assumption is that the magnitude of bed scour protection will match the instream works zone which is 10m upstream and downstream and at the banks. This is a greater extent than will be required upon detailed design. Such scour protection will incorporate "roughness" elements (e.g., mortared stone riprap) to provide flow diversity (turbulence) as cover for migrating fish. Bankside scour protection will be rocky riprap, which will be embedded into the earthen banks, or willow spiling. This will be agreed with Inland Fisheries Ireland in advance. Installation of a headwall on the inlet to an existing culvert crossing on the Brittas Wood access road. No works are required on the culvert's outfall to the Clodiagh River.
- **Area 2 (Chapel Street):** Bankside works on western bank (LHS) to bolster the existing stone wall and install a below ground flow cut-off (linear length = 235m). Work is restricted to the landside of the wall with no interference to the channel or bank face of the River Clodiagh.
- **Area 3 (Tullamore Road):** New retaining wall (linear length = 70m) on the eastern bank (RHS) to provide protection to the Uisce Éireann Integrated Constructed Wetlands (ICW) Wastewater Treatment Plant. New set-back embankment (linear length = 150m) along the western bank (LHS) (Tullamore Road). These works do not require interference with the channel or bank face of the River Clodiagh. Noted is that the ICW's treatment 'cells' are surrounded by embankments and are not predicted to flood during the 1%AEP event (see Appendix 1).

Table 3-2 sets out the Article 4(7) Applicability Assessment for Clodiagh (Tullamore)_010 RWB.

[2] LHS = true left-hand side, i.e., left bank facing downstream

[3] RHS = true right-hand side, i.e., right bank facing downstream

Table 3-2 Article 4(7) Applicability Assessment Clodiagh (Tullamore)_010

CLODIAGH (TULLAMORE)_010 RWB [IE_SH_25C060220]						
Starting point: EPA assigned status (2016 - 2021) is 'good', based on monitored biological elements (macroinvertebrates) + general physicochemical and hydromorphological supporting conditions.						
Modification(s) proposed: Proposed new physical modifications affect three separate reaches of the RWB (as described above): (1) Area 1 (Brittas Wood) – new set-back embankment, instream debris trap on Clodiagh River. Minor culvert remediation on adjoining Brittas Stream, (2) Area 2 (Chapel Street) – bolstering existing flood walls; installation of below ground cut-off wall. (3) Area 3 (Tullamore Road) – new set-back embankment and new retaining wall.						
Effect of modification (Proposed Scheme): Detailed analysis of hydraulic modelling for 50% AEP and 1% AEP flood scenarios is presented in **Appendix 2**. The only notable changes to mean cross-section velocity and froude number are at a short reach in Area 1 (Brittas Wood) in relation to the proposed debris trap.: during 50% AEP flows mean cross section velocity will decrease immediately upstream of the debris trap whilst downstream it will increase compared to baseline. The effect is very localised - there is no post-scheme change relative to baseline within approximately 10m upstream or downstream of the structure. The effect of impoundment (i.e., decreased upstream channel velocity and Froude number) is even more evident at higher flows (1% AEP flood event). The debris trap is thus likely to create a beneficial hydraulic refuge for fish during elevated flows. Noted also is that mean annual flows are, by definition, lesser than the modelled flood flows and any effect of the debris trap would remain highly localised. Hydraulically, the debris trap affects a very short channel reach and is positive for biological quality elements during elevated flows (as it introduces hydraulic refuge). Given there is an abundance of good/excellent salmonid habitat available, there will be no significant effect on fish recruitment and population structure at a waterbody scale (as a potentially defining biological quality element (BQE) under WFD Annex V). Apart from the highly localised effect of the debris trap (slight negative and slight positive effects), the hydraulic analysis shows no changes to the hydraulic regime throughout the rest of Area 1 and imperceptible to no change in Areas 2 and 3. There will be no significant changes to bed sediment mobilisation, transport or deposition as relates to macroinvertebrate and salmonid spawning / nursery habitat. No changes arise in terms of river continuity, i.e., the debris trap does not introduce a barrier to fish movement. With mitigations in place to ensure roughness in the scour protection at the debris trap, plus reinstatement of bed substrates (gravel, cobble) as part of the construction phase, there will be no long-term significant changes to hydromorphology (as defined by attributes in WFD Annex V) that could impinge on biological quality elements or supporting physico-chemical elements that define water body status. The ICW treatment cells are not predicted to flood under the 1%AEP event (see **Appendix 1**), hence no cause for entrainment of untreated pollutants and no cause for water quality deterioration in the Clodiagh (Tullamore)_010 or downstream waterbodies. Good surface water body status will be maintained in Clodiagh (Tullamore)_010 which is in line with WFD Article 4(1) objectives.						

Quality elements	**Biological quality elements (BQEs)**	**Hydromorphological quality elements supporting the BQEs**			**GPC**	**Overall ecological status**
	Macroinverts (Q-value)	Hydrology	Morphology	Continuity		
Starting point (EPA data 2016-2021)	G	≤G*	≤G*	≤G*	≤G*	G
Effect owing to modification	G	≤G*	≤G*	≤G*	≤G*	G

Ecological Status Classes - H: High; G: Good; M: Moderate; P: Poor; B: Bad

** "supporting conditions" are, by definition, equal to or poorer than highest BQE value*

Clonaslee West GWB: A relatively small groundwater body (22km^2) located at the base of the northwestern slopes of Slieve Bloom. This is a regionally important fissured aquifer that underlies the proposed embankment and flood wall defences in Area 1 (Brittas Woods) and Area 2 (Chapel Street). **Table 3-3** sets out the Article 4(7) Applicability Assessment for Clonaslee West GWB. There are a number of wells, the most notable being those that contribute to the Clonaslee water supply for which the GWB and the surface waters of the Clodiagh and Gorragh rivers are the raw sources (see details in Chapter 10: Land, Soils, Geology and Hydrogeology).

Table 3-3 Article 4(7) Applicability Assessment Clonaslee West GWB

GWB: Clonaslee West [IE_SH_G_066]			
Starting point: Overall groundwater quantitative status is classified as "good" since each criterion meets the conditions for "good" status.			
Effect of Proposed Scheme: As set out in the EIAR (**Chapter 10** Land, Soils, Geology and Hydrogeology**, Section 10.4)** the excavation works are superficial during construction and it is unlikely that the regional water table will be encountered during temporary construction works. There are no ground water dependent terrestrial ecosystems (GWDTE) affected by the scheme (Chapter 10, Section 10.3.15). The Proposed Scheme does not involve groundwater abstraction and will not affect existing levels of groundwater abstraction (i.e., Clonaslee Public Water Supply). The proposed physical modifications do not alter groundwater flow or levels and therefore do not impinge on the quantitative attributes. With mitigations implemented as prescribed in the EIAR in the area of surface water quality protection (Chapter 11 Water, Section 11.5), there will be no infiltration of construction phase pollutants that could adversely affect groundwater chemical status. Given the small, discrete areal extents of the Proposed Scheme footprints there will be no operational phase changes to overlying surface water quantity or quality (i.e., potential groundwater recharge) associated with the project. The residual effect on quantitative and chemical status of the Clonaslee West GWB will be neutral. 'Good' GWB quantitative status will be maintained in line with WFD objectives.			
		Starting point	**Effect of modification**
Quantitative Criteria	1) Available GW resource is not exceeded by the long term annual average rate of abstraction	G	G
	2) No significant diminution of surface water chemistry and/or ecology resulting from anthropogenic water level alteration or change in flow conditions that would lead to failure of Article 4 objectives for any associated surface water bodies?	G	G
	3) No significant damage to GW dependent terrestrial ecosystems resulting from an anthropogenic water level alteration;	G	G
	4) No saline or other intrusions resulting from anthropogenically induced sustained changes in flow direction.	G	G
Overall groundwater status		G	G
WFD GWB Status Classes - G: Good; P: Poor			

Geashill GWB: A moderately large groundwater body (280km^2) adjoining Clonaslee West GWB and underlying the proposed works in Area 3 (Tullamore Road). Aquifers within the GWB are Locally important. **Table 3-3** sets out the Article 4(7) Applicability Assessment for Geashill GWB.

Table 3-4 Article 4(7) Applicability Assessment Clonaslee West GWB

GWB: Geashill [IE_SH_G_103]			
Starting point: Overall groundwater quantitative status is classified as "good" since each criterion meets the conditions for "good" status.			
Effect of Proposed Scheme: As set out in the EIAR (Chapter 10 Land, Soils, Geology and Hydrogeology, Section 10.3) there is minimal, shallow excavation required during construction and it is unlikely that the regional water table will be encountered. There are no groundwater wells in the vicinity of the proposed works in this GWB and therefore no significant negative effects predicted on the underlying aquifer. There are no ground water dependent terrestrial ecosystems (GWDTE) affected by the scheme (Chapter 10, Section 10.3.15). The proposed flood defences are superficial and do not interfere with ground water flow in the Geashill West GWB. The works in Geashill GWB are outside the source protection area for Clonaslee Public Water Supply. The proposed physical modifications do not alter groundwater levels and therefore do not impinge on quantitative attributes. With mitigations implemented as prescribed in the EIAR in the area of surface water quality protection (Chapter 11 Water, Section 11.5), there will be no infiltration of construction phase pollutants that could adversely affect groundwater chemical status. Given the small, discrete areal extents of the Proposed Scheme footprints there will be no operational phase changes to overlying surface water quantity or quality (i.e., potential groundwater recharge) associated with the project. The residual effect on quantitative and chemical status of the Geashill GWB will be maintained in line with WFD objectives.			
		Starting point	**Effect of modification**
Quantitative Criteria	1) Available GW resource is not exceeded by the long term annual average rate of abstraction	G	G
	2) No significant diminution of surface water chemistry and/or ecology resulting from anthropogenic water level alteration or change in flow conditions that would lead to failure of Article 4 objectives for any associated surface water bodies?	G	G
	3) No significant damage to GW dependent terrestrial ecosystems resulting from an anthropogenic water level alteration;	G	G
	4) No saline or other intrusions resulting from anthropogenically induced sustained changes in flow direction.	G	G
Overall groundwater status		G	G
WFD GWB Status Classes - G: Good; P: Poor			

3.1.2 Indirectly Affected Water Bodies

The Clodiagh (Tullamore)_020 RWB adjoins the directly affected Clodiagh (Tullamore)_010 RWB, 1.2km downstream of Clonaslee. There are no physical modifications proposed in this water body as part of the Proposed Scheme. A hydrologically connected water body could only be affected indirectly by the Proposed Scheme if there was any cause for deterioration in the biological quality elements (and hence ecological status) linked to any potential for non-achievement of 'good' status in the upstream Clodiagh (Tullamore)_010 RWB. The analysis presented in **Table 3-2** above shows imperceptible or no change to hydromorphology quality (supporting the biological quality elements) as a result of the Proposed Scheme in the upstream Clodiagh (Tullamore)_010 RWB. For that reason, the connected downstream waterbody is scoped out as there is no risk that: (1) status could deteriorate or (2) 'good' status could be prevented in the downstream Clodiagh (Tullamore)_020 RWB.

The Gorragh_010 RWB (east of Clodiagh (Tullamore)_010) currently receives flood water as overflow from the Clodiagh during the 1%AEP event. This is because the existing river walls on Chapel Street have been in place for at least 100 years and whilst not being formal flood defences these have been directing flood flows eastwards (see Baseline scenario: **Appendix 1, Figure 5.1**) in the same way as the post-scheme design scenario will operate (**Appendix 1, Figure 5-5**). The flood model predicts 1%AEP flood water to reach the field adjacent to the lower 650m of the Gorragh River. The Gorragh has flood embankments (at least in part) on this lower reach but using the precautionary principle for the purposes of this assessment it is assumed that high flood overflows could potentially drain into the Gorragh River at any point on the lower (linear) 650m of the channel. For that reason, the Gorragh_010 RWB is scoped in to this assessment as an indirectly affected waterbody. **Table 3-5** sets out the Article 4(7) Applicability Assessment for Clodiagh (Tullamore)_010 RWB, noting that this is a High Status Objective (HSO) waterbody for WFD purposes. **Table 3-6** shows current and historical EPA Q-value monitoring results on the Gorragh River, which are used to support the assessment.

Table 3-5 Article 4(7) Applicability Assessment Gorragh_010

GORRAGH _010 RWB [IE_SH_25G090300]

Starting point: Gorragh_010 is a High Status Objective RWB (HSO). This means the biological quality element (BQE) and hydromophology quality elements must attain 'high' status to meet WFD objectives. Current EPA assigned status (2016 - 2021) is 'good' based on the monitored biological quality element (macroinvertebrate Q-value) + general physicochemical and hydromorphological supporting conditions. Note that the BQE is 'high' status, but hydromorphology is rated as 'good' status, which decreases overall status to 'good'. EPA (2021 and 2024) list 'hydrological' and 'morphological' conditions as significant pressures for the Gorragh_010 noting "*Abstraction for Tullamore public water supply*" and "*barrier(s) to fish migration*" were as reasons preventing high status for hydromorphological condition.

Modification(s) proposed: There are no physical modifications proposed on the Gorragh itself, but the lower river reach is predicted to continue to receive flood water during the 1%AEP event as overflow resulting from reinforcement of existing river walls in Area 2 (Chapel Street, Clonaslee) on the Clodiagh River to the west.

Effect of modification (Proposed Scheme): The river walls on Chapel Street have been in place for at least 100 years, directing flood flows eastwards in the same way as the proposed post-scheme design scenario will operate (see Appendix 1, Figs 5-1 and 5-5). The EPA monitor Q-values (macroinvertebrate BQE) at two River Stations (RS) on the Gorragh: **(1)** RS25G090300 is located 250m upstream of the Clodiagh confluence, i.e., within the scheme Zone of Influence. It has been monitored regularly since 2008, returning high BQE status (Q4-5 or Q5) on all but one occasion and is currently at high status (2023 sampling) (Table 3-6). **(2)** RS25G090200 is located 1.6km upstream of the Clodiagh confluence and is not affected by the current scenario or the Proposed Scheme. It has been monitored regularly since 2002, returning high BQE status (Q4-5 or Q5) all but once, and is currently high status (2023 sampling) (Table 3-6). What this means is that occasional overflow of flood waters from the Clodiagh to the lower Gorragh is not causing deterioration of the BQE (Q-value) from high status. Because there is no change between the baseline and post-scheme scenarios in terms of flood overflow contribution to the lower Gorragh, there is no evidence of cause for status deterioration in the future. High status (on this HSO RWB) is therefore not precluded on the Gorragh River as a result of the proposed scheme, hence its WFD objective is not jeopardised by the Proposed Scheme. The pressures currently preventing high status are not altered by the Proposed Scheme.

Quality elements	Biological quality elements (BQEs)	Hydromorphological quality elements supporting the BQEs			GPC	Overall ecological status
	Macroinverts (Q-value)	Hydrology	Morphology	Continuity		
Starting point (EPA data 2016-2021)	H	G*	G*	G*	≤H**	G*
Effect owing to modification	H	G*	G*	G*	≤H**	G*

Ecological Status Classes - H: High; G: Good; M: Moderate; P: Poor; B: Bad

**For this EPA monitored RWB, even though the BQE was High status, hydromorphology was only rated 'Good' status in 2016-2021 reporting period, which decreases overall status to 'Good'.*
***GPC "supporting conditions" are, by definition, equal to or poorer than highest BQE value*

Table 3-6 Gorragh River – EPA Q-value monitoring

Gorragh RWB RS EPA Code	RS Name	2002	2005	2008	2011	2012	2014	2017	2023
RS25G090300	Killart House	~	~	Q4-5	Q4	Q4-5	Q4-5	Q4-5	Q5
RS25G090200	Gorragh Br E of Clonaslee	Q5	Q4	~	Q4-5	Q5	Q4-5	Q5	Q5

3.2 Article 4(7) Applicability Assessment Summary

Table 3-7 Summary of WFD Compliance Tests

EPA Water body (EPA Code)	Water body type	Deterioration of status?	Prevention of good status?	Does the proposed scheme ensure compliance with WFD Article 4(1) objectives for this water body?
CLODIAGH (TULLAMORE)_010 IE_SH_25C060220	River	No	No	Yes
Geashill IE_SH_G_103	Ground	No	No	Yes
Clonaslee West IE_SH_G_066	Ground	No	No	Yes
GORRAGH_010 IE_SH_25G090300	River	No	No	Yes
OVERALL WFD ASSESSMENT RECOMMENDATION		The project can technically be authorized under the WFD as it does not compromise Article 4(1) objectives.		

4 CONCLUSION

The Proposed Scheme, by design and with mitigations implemented as prescribed in EIAR Chapters 9 (Biodiversity), 10 (Land, Soil Geology and Hydrogeology) and 11 (Water) (as amalgamated in the Construction Environment Management Plan (Appendix 5-2) of the EIAR), will not cause deterioration of status in any water body overall or at individual quality element level which is in line with WFD Article 4(1) objectives. This document in conjunction with detailed information within the EIAR provides evidence to support the conclusion. The Proposed Scheme is compliant with WFD Article 4(1) objectives, does not require Article 4(7) derogation, and can be authorised under the WFD.

5 REFERENCES

DHLGH (2024) Water Action Plan 2024 A River Basin Management Plan for Ireland. Department of Housing, Local Government and Heritage, Ireland.

EC (2005) CIS Guidance No.13 WFD Common Implementation Strategy for the Water Framework Directive (2000/60/EC). - Overall Approach to the Classification of Ecological Status and Ecological Potential.

EC (2006) WFD and Hydromorphological Pressures Technical Report: Good practice in managing the ecological impacts of hydropower schemes; flood protection works; and works designed to facilitate navigation under the Water Framework Directive. Available at:

https://circabc.europa.eu/sd/a/68065c2b-1b08-462d-9f07-413ae896ba67/HyMo_Technical_Report.pdf (Accessed October 2024)

EC (2009) CIS Guidance No. 18. WFD Common Implementation Strategy. Guidance on Groundwater Status and Trend Assessment.

EC (2017) CIS Guidance No. 36. Water Framework Directive Common Implementation Strategy. Exemptions to the Environmental Objectives according to Article 4(7) New modifications to the physical characteristics of surface water bodies, alterations to the level of groundwater, or new sustainable human development activities.

EPA (2021) 3rd Cycle Lower Shannon (Brosna) Catchment Report (HA 25A) V1. Catchment Science & Management Unit Environmental Protection Agency. Ireland.

EPA (2024) Cycle 3 HA 25A Lower Shannon Catchment Report (May 2024). Available at: https://catchments.ie/wp-content/files/catchmentassessments/25A%20Lower%20Shannon%20Catchment%20Summary%20WFD%20Cycle%203.pdf (accessed October 2024)

APPENDIX 1 Model Predicted Flood Extents

This Appendix provides clarifications on the flood maps prepared and presented in development of the scheme design.

Do Nothing Scenario (Environmental Baseline Scenario)

This model run is the best representation of the 1% AEP event if it occurred in the present-day scenario (**Figure 5-**1). A key assumption for this model is that two informal flood defences, namely the existing wall on Chapel Street and an embankment upstream of the ICW access bridge, remain intact and act as flood defences. Anecdotal evidence confirms that this would generally be the case. The significant flood of 2017 occurred because of a storm event coinciding with a breach in the wall due to a vehicle collision. It should be noted that these defences cannot be relied upon to act as flood defences into the future.

Figure 5-1 1% AEP Model Predicted flooding in Present Day Do Nothing Scenario

The as-built topography of the Uisce Éireann Integrated Constructed Wetlands (ICW) Wastewater Treatment Plant has been reflected in the Digital Terrain Model (DTM) within the Hydraulic Model. The ICW's treatment 'cells' are surrounded by embankments. A pre-existing field drain was retained and enlarged during construction of the ICW. As a result, the treatment cells of the ICW are not predicted to flood, and the drain is sufficiently sized to convey floodwater through the ICW from south to north.

Undefended Scenario

To get an understanding of the flood risk to properties in the scenario where the informal defences fail, a model was created with those defences removed. This model scenario was used to highlight the potential damages that the scheme will prevent (**Figure 5-2**).

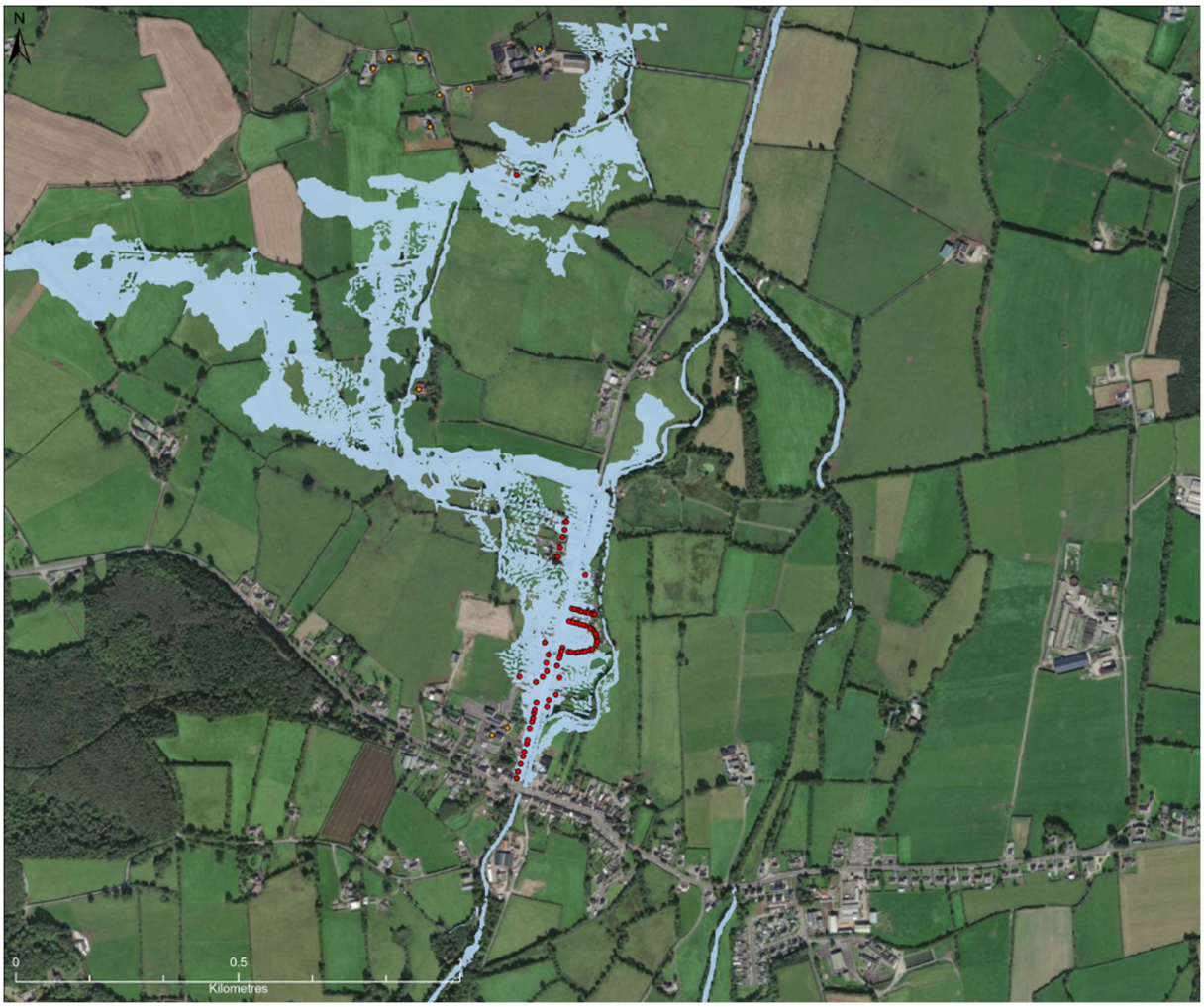

Figure 5-2 1%AEP event in the Undefended Scenario (incl. properties at risk)

The total area at risk of flooding is deemed to be a composite of the floodplain in both scenarios where (i) when the informal defences remain intact and (ii) when the informal defences are breached.

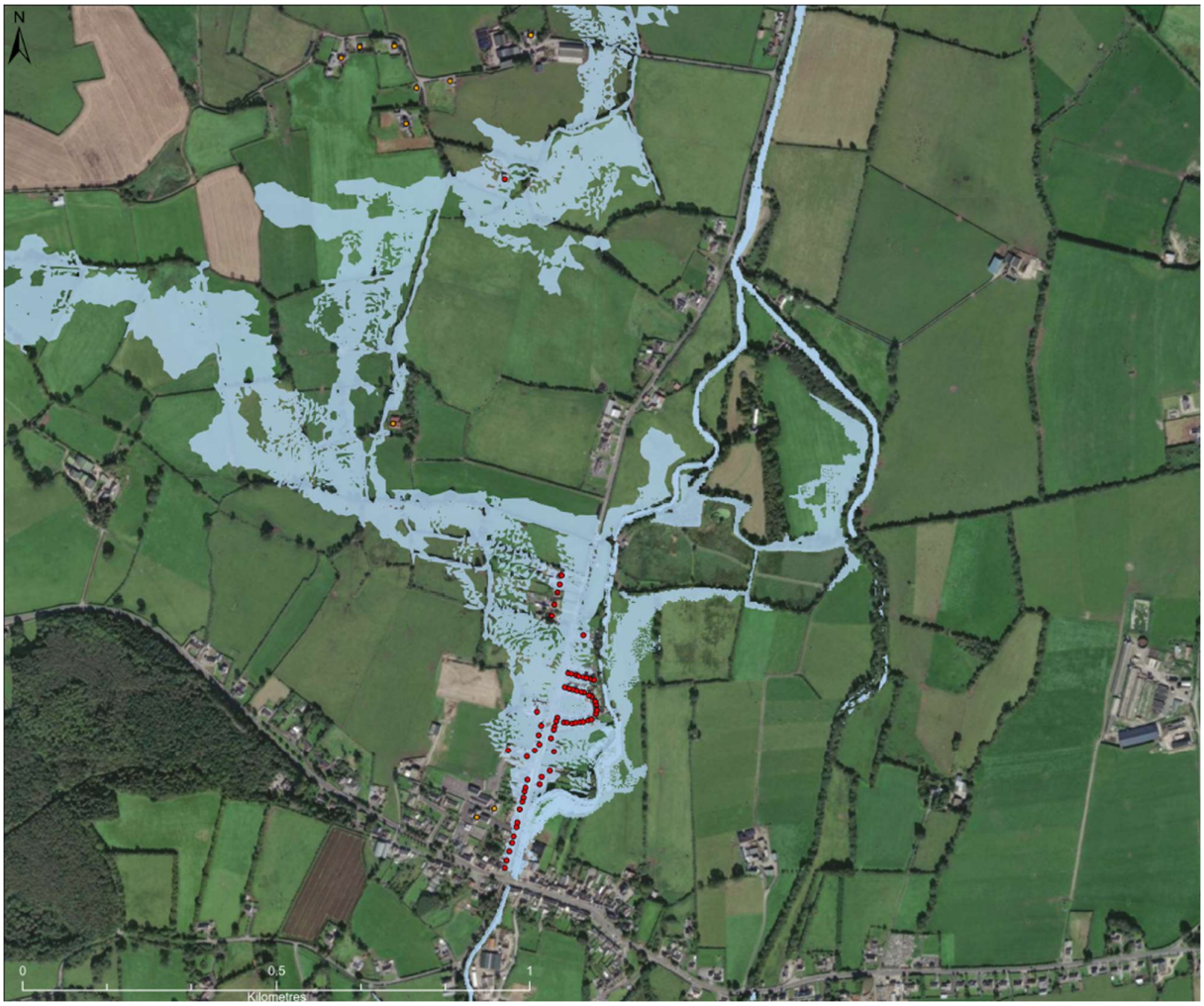

Figure 5-3 Pre-Scheme Composite Flood Risk Zone

Pre-Scheme CFRAMs Mapping

For completeness, it is important to be aware of the currently publicly available flood mapping, generated during the CFRAM programme (see **Figure 5-3**). As with the 'Undefended' scenario (**Figure 5-2**), the CFRAMs models did not include built structures and embankments that were not designed and recorded as flood defences.

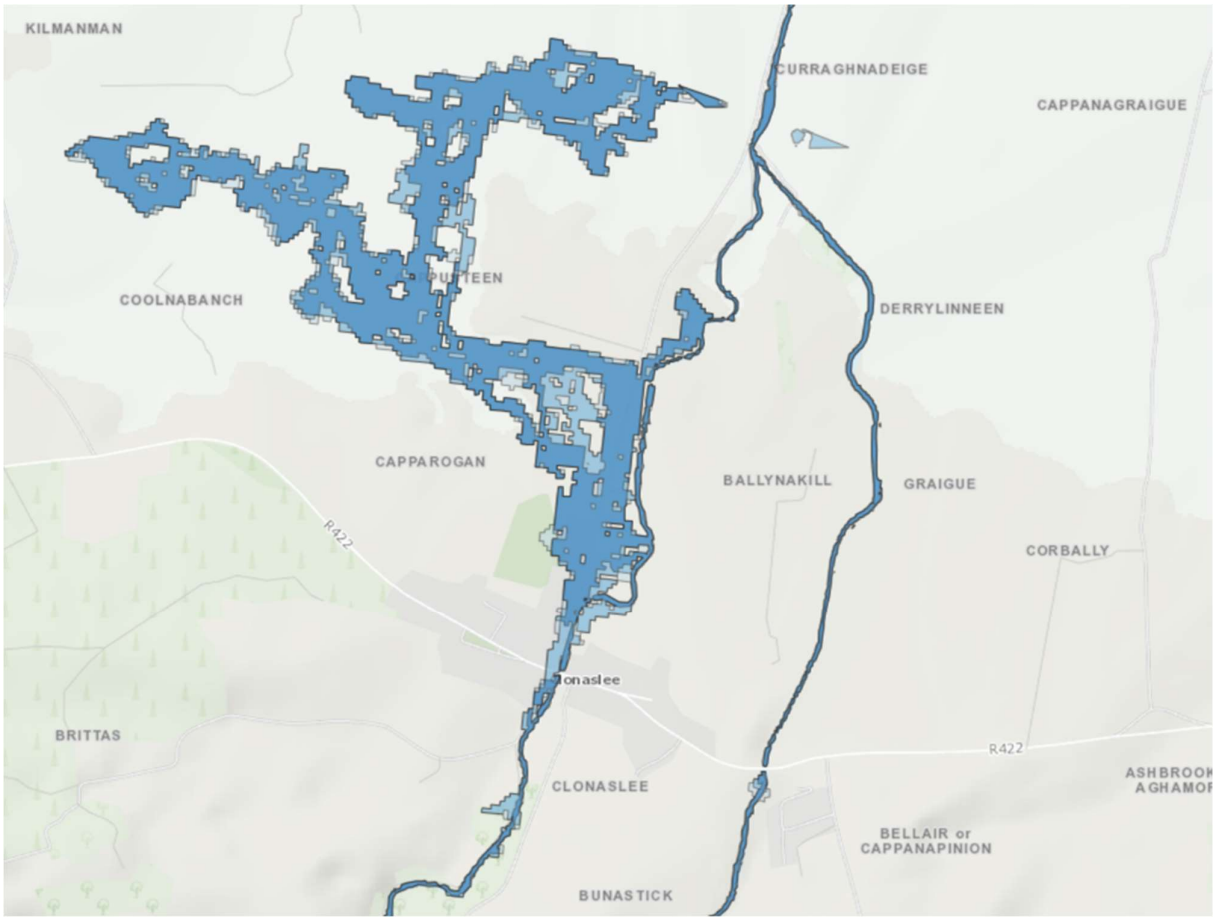

Figure 5-4 CFRAMs Mapping from www.floodinfo.ie

Post-Scheme Scenario

The Clonaslee Flood Relief Scheme will upgrade and formalise the existing defences described above and ensure their integrity into the future. It will also install a debris trap in the Clodiagh River to prevent blockages at the bridge in Clonaslee. This is a flooding mechanism that was identified during Public Information Events.

Intuitively, the post-scheme flood model (**Figure 5-4**) presents a very similar picture to the 'Do Nothing' Scenario (**Figure 5-1**).

Figure 5-5 Post-scheme 1% AEP Model Predicted Flooding

APPENDIX 2 Hydraulic Data Analysis

To assist in assessment of potential impacts on the hydraulic environment of the Clodiagh River, baseline and post-scheme values for two hydraulic parameters were examined: channel velocity (m/s) and froude number. Modelled hydraulic changes were examined for 50%AEP and 1%AEP flood scenarios at river cross-sections that span the channel reaches where flood defences are proposed.

Examination of water velocity changes assists in determining potential for changes to bed sediment (substrate) mobilisation, transport and deposition, plus suitability of habitat for salmonid spawning and nursery. Substrate type and hydrological conditions underpin the 'morphology' sub-element of the WFD Annex V hydromorphological quality element that 'supports' the biological quality elements.

Froude number is a dimensionless descriptor of the flow environment of a river calculated as a function of depth and velocity. It is a useful signifier of hydraulic habitat in relation to salmonid spawning and nursery habitat, being more versatile than river velocity or depth alone (Moir *et al*, 2002). Whilst larger fish tend to spawn in deeper, faster waters than smaller fish; the froude number within their selected spawning habitats has been found to be very similar. As an expression of depth-velocity character, it is thus comparable between different sized rivers and different sized fish. The relationship between mean depth / velocity and froude number for salmonids is set out in **Figure A1.1** (reproduced from Moir et al. 2002), using amalgamated data from the literature (as listed).

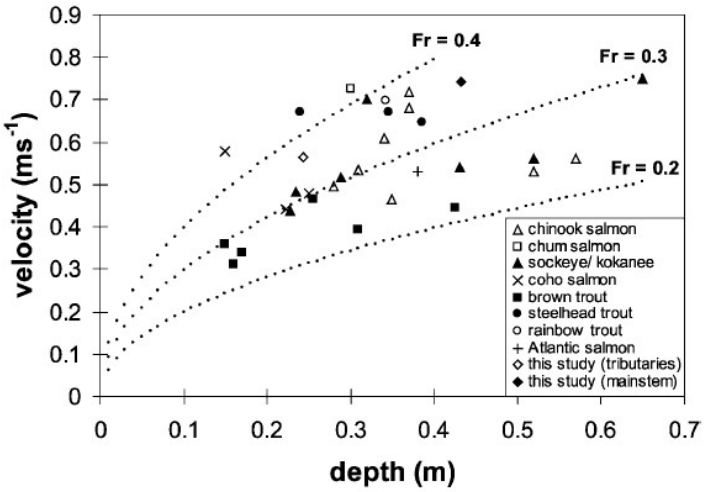

Fig. 8. Plot of mean depth and velocity-use data by spawning salmonids from the literature (Beland et al., 1982; Briggs, 1953; Burner, 1951; Delisle, 1962; Deverall et al., 1993; Grost et al., 1990; Hamilton and Remington, 1962; Hoopes, 1972; Kondolf, 1988; Mullner and Hubert, 1995; Orcutt et al., 1968; Parsons and Hubert, 1988; Sams and Pearson, 1963; Shirvell and Dungey, 1983; Smith, 1973; Swan, 1989; Witzel and MacCrimmon, 1982) and this study. Dashed curves represent Froude number equal to 0.2, 0.3 and 0.4.

Figure A1.1 Velocity, depth and froude number relationship (reproduced from Moir et al. 2002)

Moir et al (2002) demonstrated that salmon in Scottish mainstem and tributary streams spawn in a wide variety of depths (0.12 to 0.66m) and velocities (0.22 to 1.29 m/s), but that the froude number was very consistent with the optimal range being 0.3 to 0.44 (mean 0.38). For trout (*Salmo trutta*) the reported froude number range is 0.2 to 0.3 (Fig. 9-3). Armstrong et al (2003) reviewed published literature regarding habitat utilisation by Atlantic salmon and brown trout. Salmon were reported spawning in areas at average water velocities of 0.40 to 0.54 m/s, with nursery waters averaging 0.10 to 0.40 m/s (mean column velocity). Trout spawning was reported in mean water velocities of 0.39 to 0.47 m/s with nursery habitat having mean column velocities of 0 to 0.5 m/s. Spawning and nursery habitats of both species tend not to exceed mean column velocity of circa 1.0 m/s.

Velocity and froude number were used to examine baseline and post-scheme changes for smaller, higher frequency (50%AEP) and larger, lower frequency (1%AEP) flood events at Areas 1, 2 and 3 on the Clodiagh River (**Figure A1.1).**

Area 1: Brittas Wood Embankment and Debris Trap (DT)

Figure A1.2 illustrates modelled Area 1 cross-section data showing baseline and post-scheme comparisons for flood velocity and froude number at 50%AEP and 1%AEP flood events. **Figure A1.3** (below) shows the cross-section locations. Notable differences in velocity and froude number are evident only very locally in relation to the short reach around the debris trap (DT US and DT DS). The effect is mainly apparent at 50%AEP flood flows, which shows post-scheme increases just downstream, and less pronounced decreases in both parameters upstream of the debris trap.

During the modelled 1% AEP event, post-scheme velocity and froude number will decrease upstream of the debris trap (likely a slight impoundment effect) but there are no notable differences downstream. Yellow bars show the optimal froude band for salmonid spawning. Even at baseline, both the froude number (>0.44) and mean cross-section channel velocities (>1m/s) are not ideal at these elevated flow scenarios along most of the channel reach, noting that mean annual values for these parameters would be, by definition, less than those that occur during flood events. The debris trap may even have a positive effect on fish during very elevated flow as the bollards create a hydraulic refuge (reduced channel velocity). At low flows, there will be no changes to hydraulic parameters because there is no impact from the set-back embankment since flows remain in-bank.

Except for the highly localised effect at the debris trap, mainly during 50% AEP flows, there are either no changes or insignificant changes between baseline and post-scheme modelled velocity and froude number. Hence no significant change is predicted along most of this channel reach in relation to quality of macroinvertebrate and salmonid habitats as relates to the hydromorphology quality elements supporting the biological quality elements that define waterbody status.

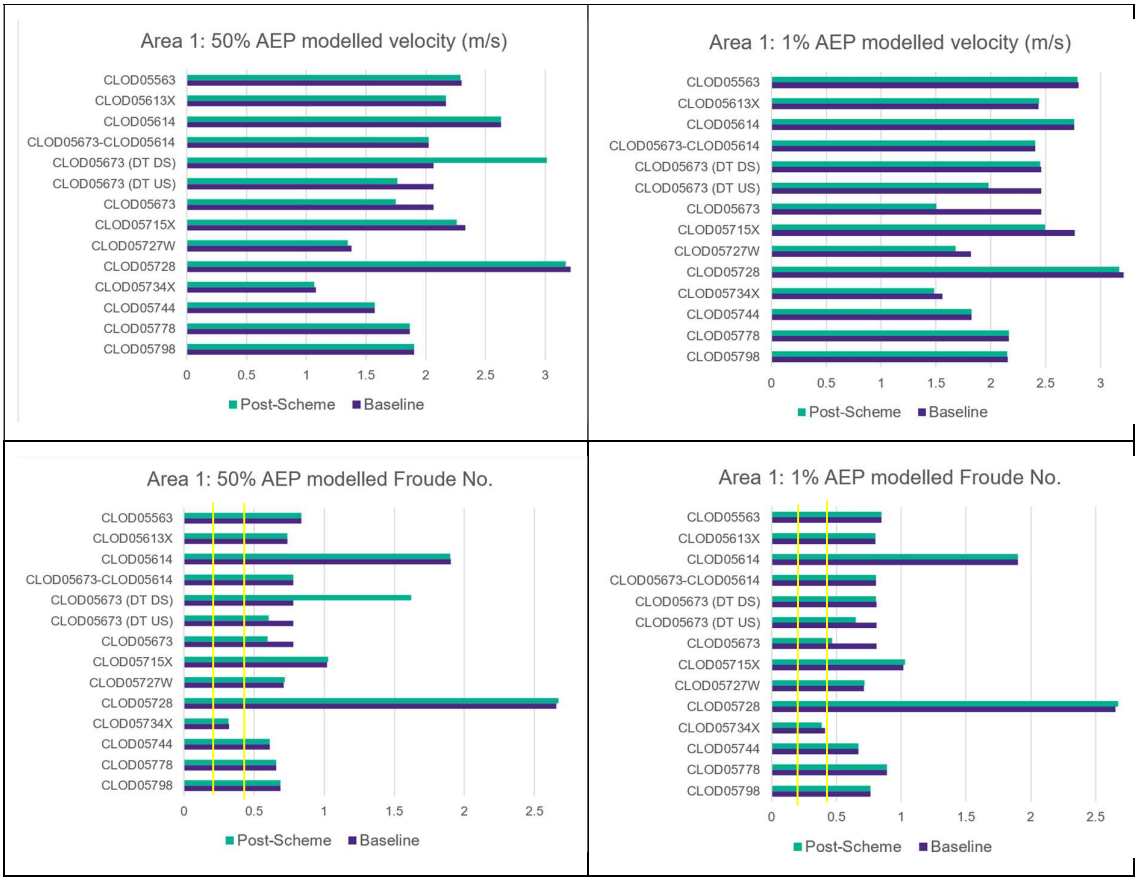

Figure A1.2 Clodiagh River Area 1 cross-sections – modelled channel velocity and froude number comparison

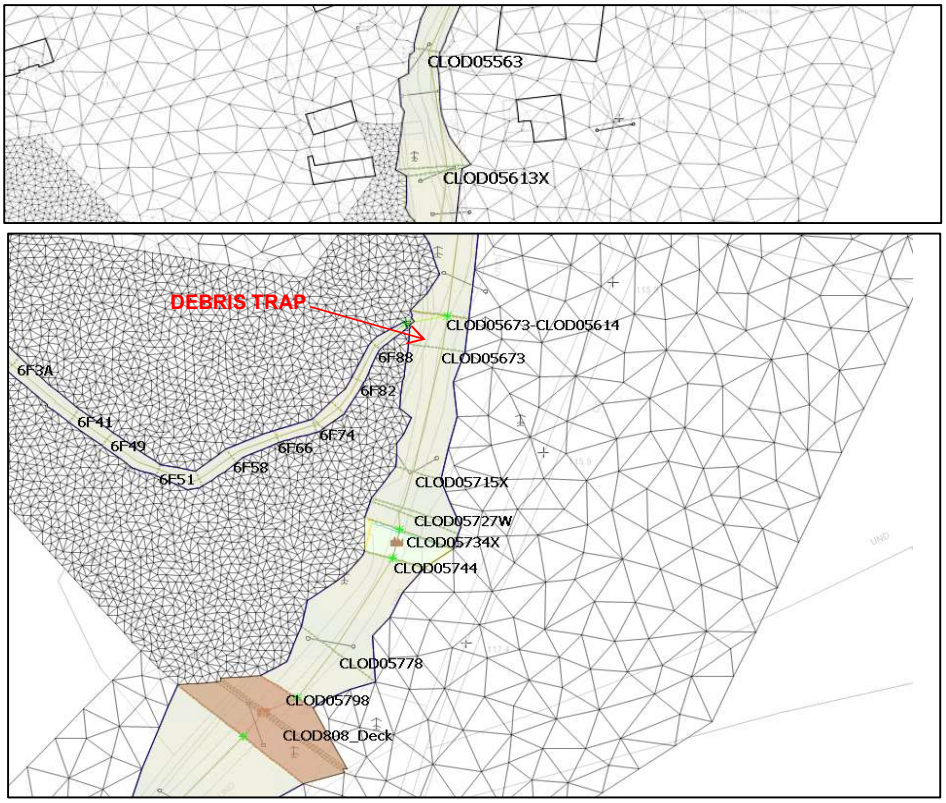

Figure A1.3 Location of Clodiagh River Area 1 cross-sections in relation to embankment and debris trap

Area 2: Chapel Street Flood Walls

Figure A1.4 illustrates Area 2 modelled cross-section data showing baseline and post-scheme comparisons for flood velocity and froude number at 50%AEP and 1%AEP flood events. **Figure A1.5** (below) shows the cross-section locations. There are insignificant differences in velocity and froude number for both flood scenarios. Yellow bars show the optimal froude number band for salmonid spawning. Noted is that even at baseline, both the froude number (>0.44) and mean cross-section channel velocities (>1m/s) are not ideal at these elevated flow scenarios along most of the channel reach although mean annual values for these parameters would be, by definition, less than those that occur during flood events. This is likely the result of existing urban channel constriction.

There is an imperceptible post-scheme change predicted along this channel reach in relation to quality of macroinvertebrate and salmonid habitats as relates to the hydromorphology quality elements supporting the biological quality elements that define waterbody status.

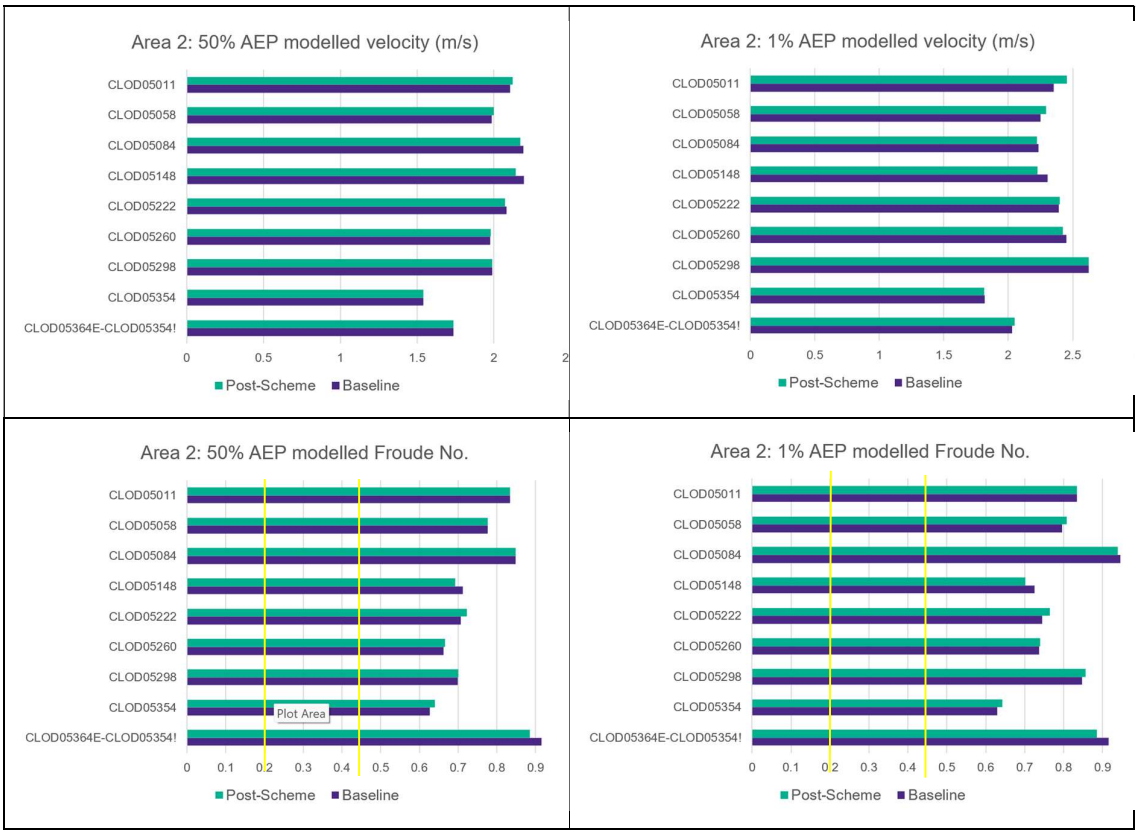

Figure A1.4 Clodiagh River Area 2 cross-sections – modelled channel velocity and froude number comparisons

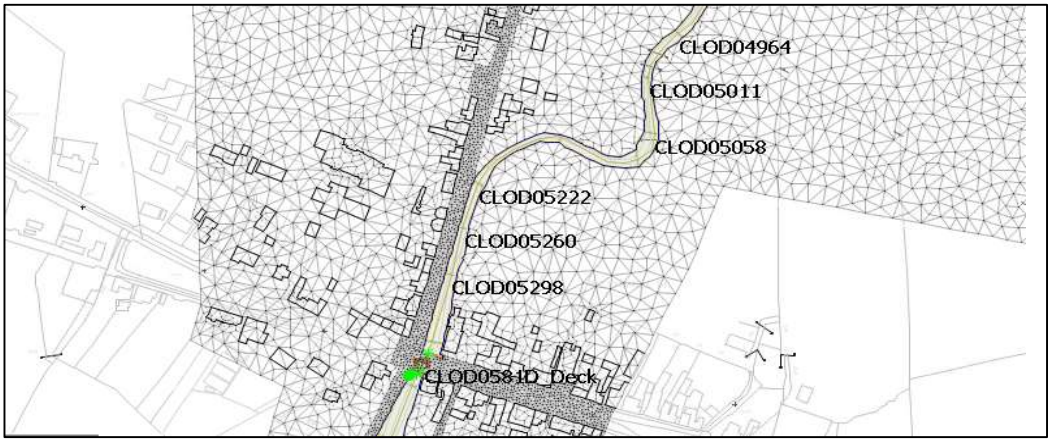

Figure A1.5 Location of Clodiagh River Area 2 cross-sections in relation to flood walls

Area 3: Tullamore Road Embankment and ICW Flood Wall

Figure A1.4 illustrates Area 2 modelled cross-section data showing baseline and post-scheme comparisons for flood velocity and froude number at 50%AEP and 1%AEP flood events. **Figure A1.5** (below) shows the cross-section locations. There are insignificant differences in velocity and froude number for both flood scenarios. Yellow bars show the optimal froude number band for salmonid spawning. Noted is that even at baseline, both the froude number (>0.44) and mean cross-section

channel velocities (>1m/s) are not ideal at these elevated flow scenarios along most of the channel reach. This is likely the result of existing channel constriction.

There is no post-scheme change predicted along this channel reach in relation to quality of macroinvertebrate and salmonid habitats as relates to the hydromorphology quality elements supporting the biological quality elements that define waterbody status.

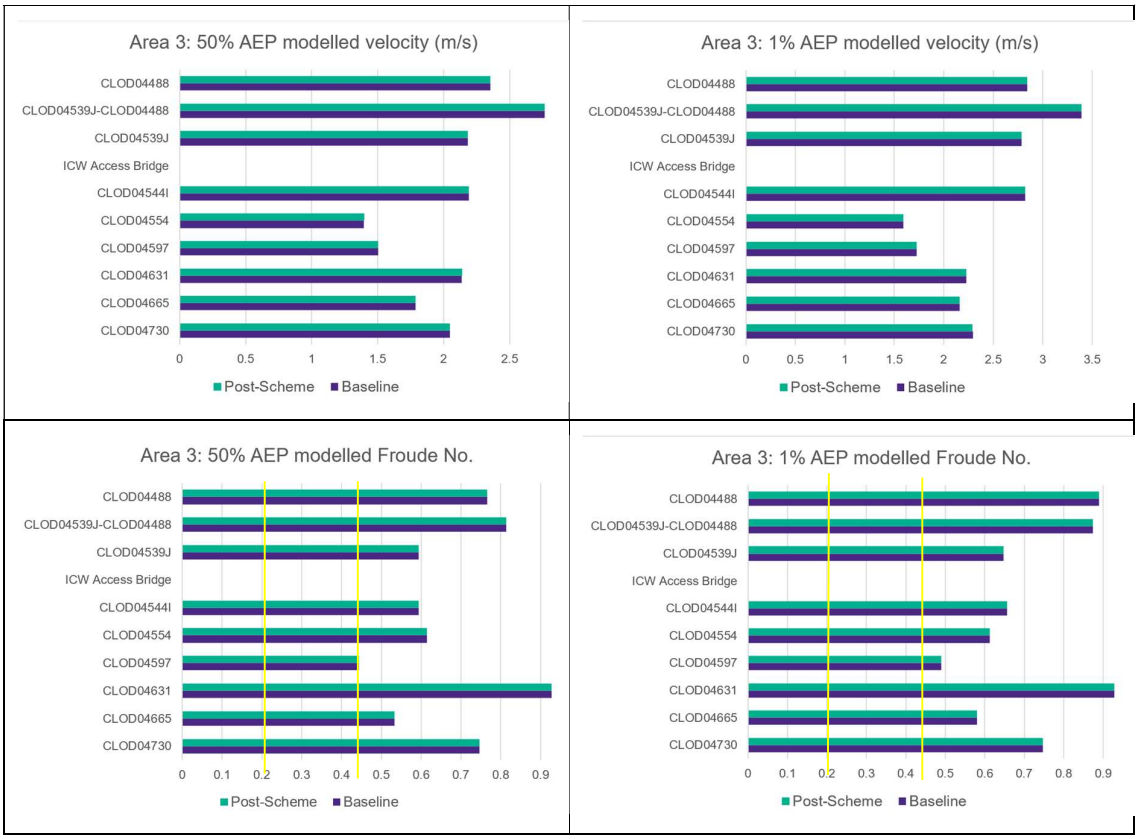

Figure A1.4 Clodiagh River Area 3 cross-sections – modelled channel velocity and froude number comparisons

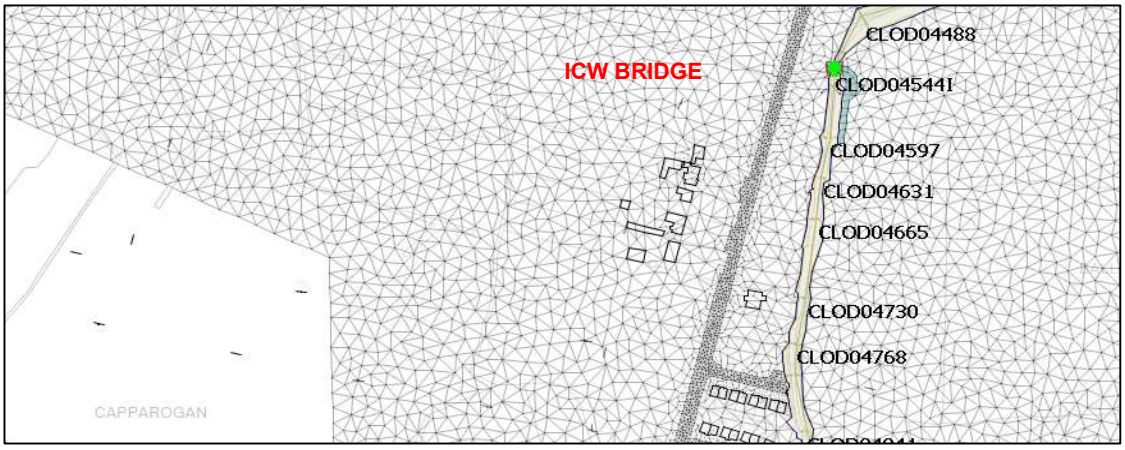

Figure A1.5 Location of Clodiagh River Area 3 cross-sections in relation to embankment and ICW flood wall